

1999



# Optimizing the Survivability of the Light Armored Vehicle with Modeling and Simulation

Tony R. McKheen, U.S. Army TARDEC

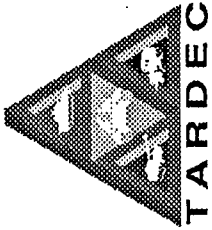
Rod Peterson and Mylene Ouimette, NSWC-CD

Kent Pankratz, Booz-Allen & Hamilton, Inc.

GTMV 99

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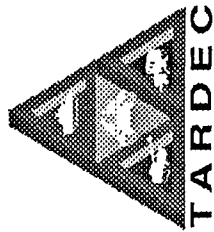


# Background

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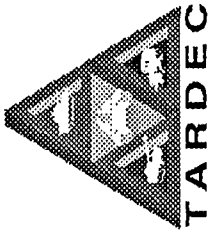
- LAV is entering a Service Life Extension Program (SLEP) to ensure that it will remain a viable weapon platform through 2015
- Survivability is one of the main concerns
- Requirements stated in vague terms
- Cost and weight must be kept to a minimum
- Why M&S?



## Models Used



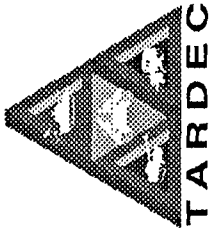
- TOSOM
- CASTFOREM
- Groundwars
- GENESIS
- NVESD Model



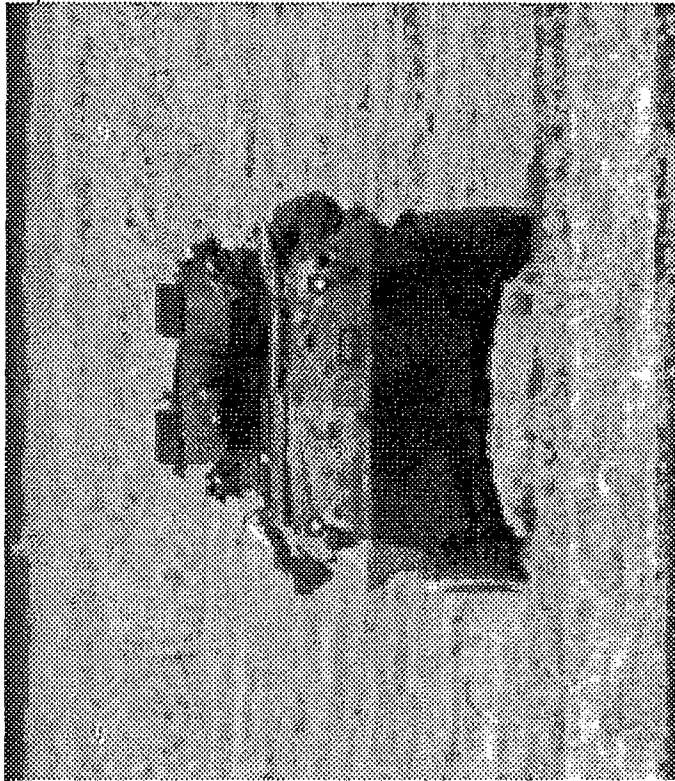
# LAV Baseline



- NSWC-CD and ATC created a database of LAV baseline signatures to include:
  - Thermal (3-5 and 8-12  $\mu\text{m}$ )
  - Near Infrared
  - Visible
  - Radar
- Imagery includes at range, diurnal, and turntable
- Provides input data for modeling

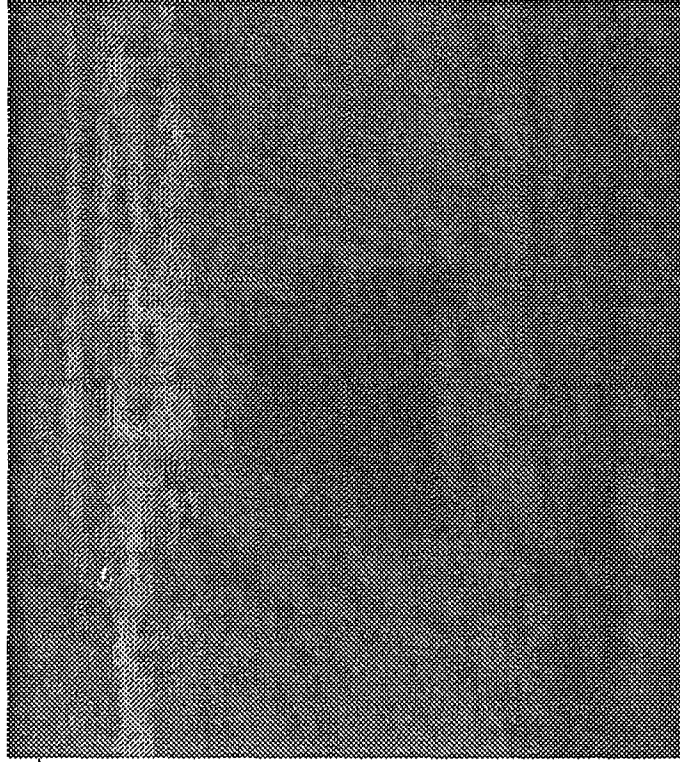


# Imagery Examples



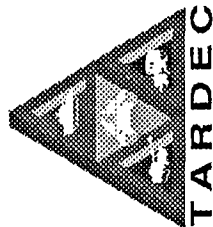
**Visible**

Imagery was collected by  
Aberdeen Test Center at  
Aberdeen Proving Ground,  
MD.



**NIR**

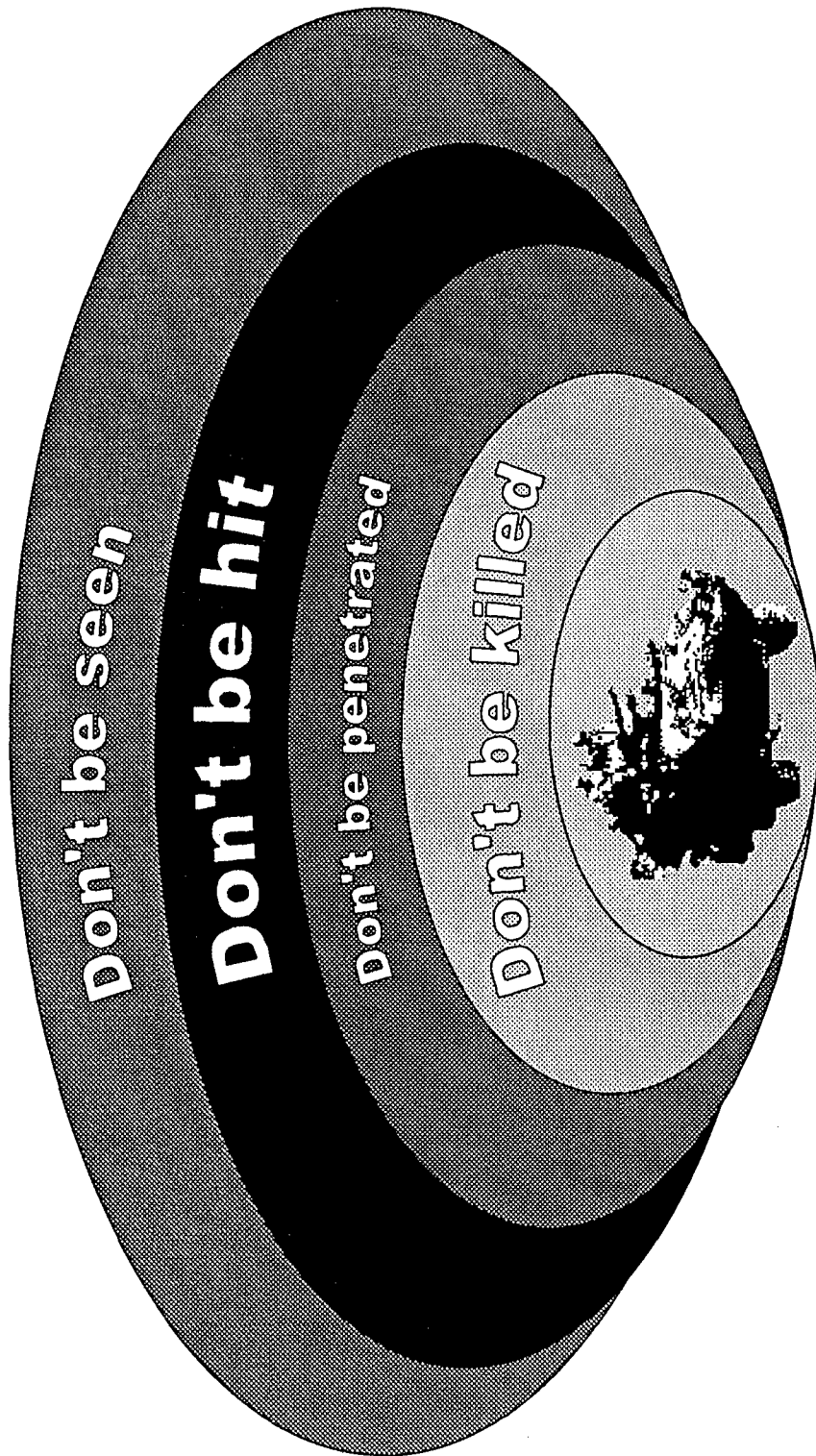
At range imagery  
examples. Images  
were also taken from  
turntable and diurnal.



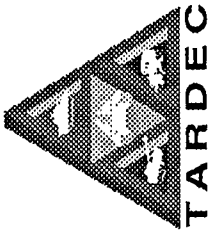
# TOSOM Analysis



Where do we put the \$\$?



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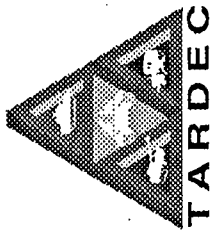


# TOSOM Analysis

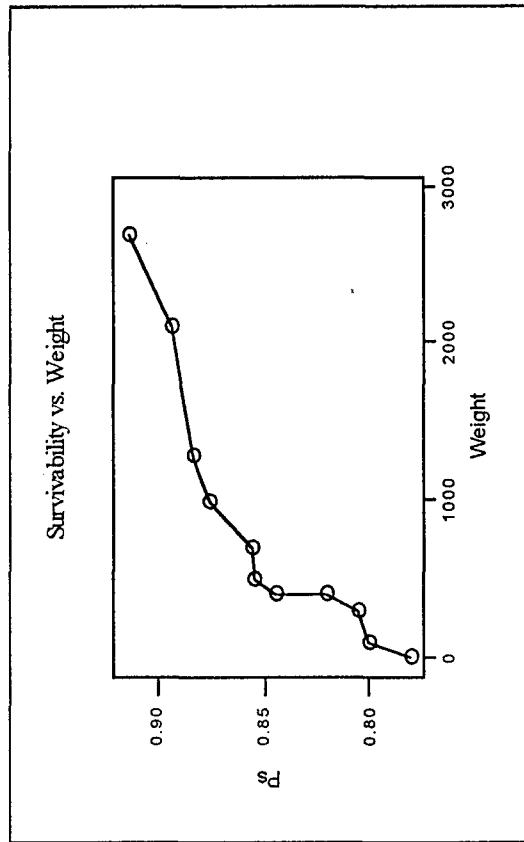
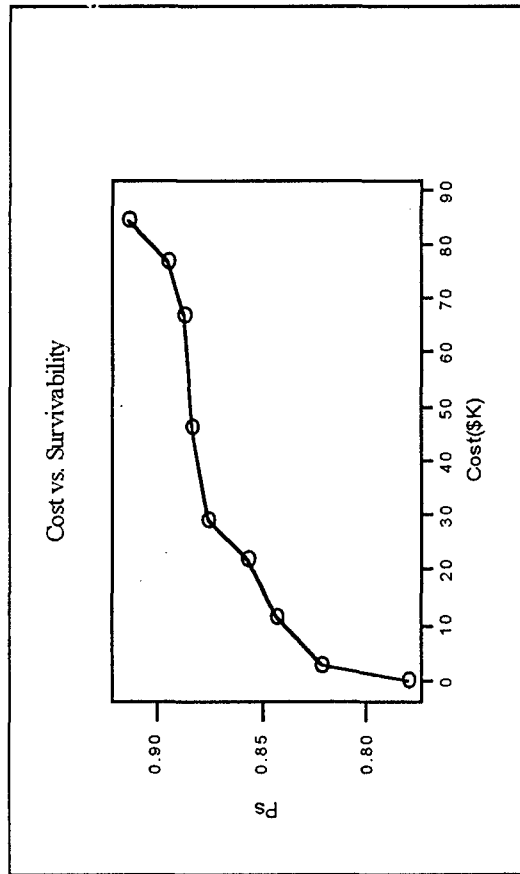


- Threat database developed by Teledyne Brown Engineering and approved by MCIA
- Three different threat scenarios
- Considered a total of ten survivability improvements
- Exhaustive enumeration method was used for the analysis

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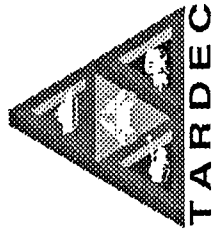


# Sample Results



- Used TOSOM to optimize survivability with cost and weight at manageable risk
- Results

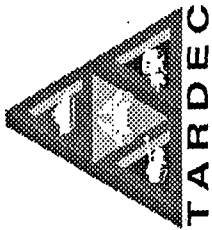




# CASTFOREM



- TRAC-WSMR was tasked by NSWC-CD and MCSC-AWT to perform a CASTFOREM analysis
- This effort included incorporating signature data into the analysis
- Considered two types of scenarios
- Analysis considered different armaments, sensors, and survivability levels on the LAV

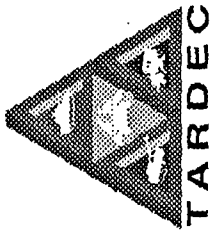


# CASTFOREM



Alternative	LAV-25		LAV-AT		LAV-M	
	Armament	Survivability	Sensor	Armament	Survivability	Sensor
Baseline	25mm	Baseline	X	TOW II	Baseline	X
Survivability 1	25mm	Survivability 1	X	TOW II	Survivability 1	X
Survivability 2	25mm	Survivability 2	X	TOW II	Survivability 2	X

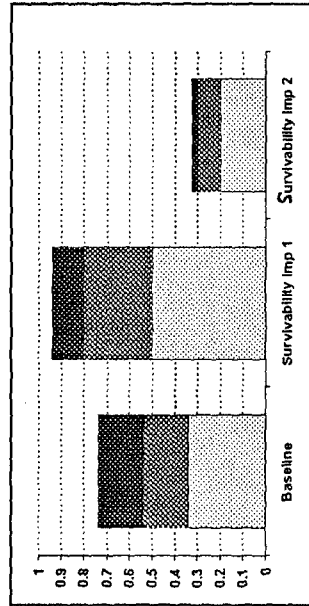
- Example of alternatives used in the analysis
- Different survivability levels on different variants



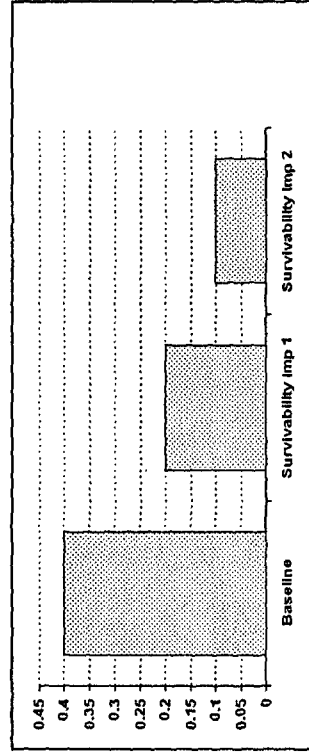
# Sample Results



*Number of Blue Killed by Threat*



*Number of 1st Detections of Blue by Threat*



- CASTFOREM provided information about the combat effectiveness of survivability improvements as well as several other modifications

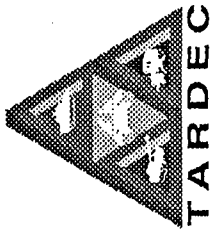
- Results



TRAC-WSMR POC Mr. David Kelly

LAV Future Capabilities Analysis Brief, 29 Jan 99

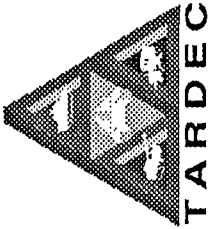
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# Groundwars



- Analysis conducted by Booz-Allen & Hamilton
- Army-approved AMSAA Model, Version 5.33
- Modified to examine aspect-wise signatures
- Few-on-Few, Stochastic Model
- Scenario:
  - LAV fights for information during a zone recon
  - SWA Terrain
  - 8 Blue versus 8 Red for initial run matrix
  - Similar sensor capabilities for Red and Blue
  - Alternatives examine LAV with survivability improvements

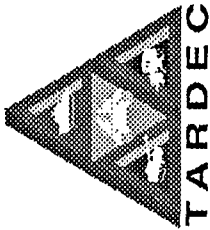


# Sample Results



	<u>Base</u>	<u>S1</u>	<u>S2</u>	<u>S3</u>
Red Losses	W	X	Y	Z
Blue Losses	A	B	C	D
SER	W/A	X/B	Y/C	Z/D

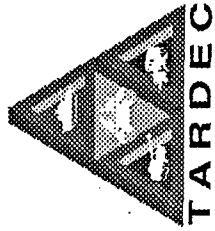
- Combat effectiveness of signature improvements in terms of System Exchange Ratio (SER)
- LAV detectability for different signature improvements



# Other Models



- GENESIS
  - Prepared for AMSAA's Smart Weapons Management Office by the Illinois Institute of Technology Research Institute (IITRI)
  - Used to evaluate the effectiveness of smart munitions
- NVESD Model
  - Instrumental in determining technical specification development and test requirements
  - Uses AMSAA/NVESD provided data
  - Two scenarios used



# Conclusions



- Modeling and simulation aided in:
  - determining where to put the money
  - effectiveness of solutions
  - technical specification development
  - identification of vulnerabilities
  - basis for decision-making in selecting survivability technologies

# OPSEC REVIEW CERTIFICATION

(AR 530-1, Operations Security)

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## Description of Information Reviewed

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Reviewer's Determination (check one):

☒ 1. Unclassified Unlimited.

☐ 2. Unclassified Limited, Dissemination Restrictions IAW \_\_\_\_\_

☐ 3. Classified. Cannot be released, and requires classification and control at the level of \_\_\_\_\_

The presentation is a generic description of the use of survivability optimization models. Only the models and methodology are detailed and no specific results are presented. The Marine Corp LAV office coauthored the presentation and along with the author, support unclassified, unlimited release. I also have technically reviewed the presentation and support an unclassified, unlimited release at the conference. W. Muck 12 Aug 99

I am aware that there is foreign intelligence interest in open source publications. I have sufficient technical expertise in the subject matter of this paper to make a determination that the net benefit of this public release outweighs any potential damage.

Reviewer: Wallace R. Muck GS-14 Mechanical Engineer, Acting Team Leader  
Name Grade Title

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Name: Shepard Date: 16 Aug 99

Public Affairs Office (AMSTA-CS-CT): ☒ Concur/ ☐ Nonconcur

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